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Electrical relays - Part 16: Impedance measuring relays

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Relais électriques - Seizième partie: Relais de mesure d'impédance

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

ELECTRICAL RELAYS

Part 16: Impedance measuring relays

FOREWORD

1) The formal decisions or agreements of the IEC on technical matters, prepared by Technical Committees on which all the National Committees having a special interest therein are represented, express, as nearly as possible, an international consensus of opinion on the subjects dealt with.

2) They have the form of recommendations for international use and they are accepted by the National Committees in that sense.

3) In order to promote international unification, the IEC expresses the wish that all National Committees should adopt the text of the IEC recommendation for their national rules in so far as national conditions will permit. Any divergence between the IEC recommendation and the corresponding national rules should, as far as possible, be clearly indicated in the latter.

PREFACE

This standard has been prepared by Sub-Committee 41B: Measuring Relays and Protection Equipment, of IEC Technical Committee No. 41: Electrical Relays.

Drafts were discussed at the meetings held in Nice in 1976, in Milan in 1977 and in Helsinki in 1979. As a result of this meeting, a draft, Document 41B(Central Office)24, was submitted to the National Committees for approval under the Six Months' Rule in April 1980.

The National Committees of the following countries voted explicitly in favour of publication:

Austria	Romania
Belgium	South Africa (Republic of)
Egypt	Spain
France	Sweden
Germany*	Switzerland
Ireland	Turkey
Israel	United Kingdom
Japan	United States of America
Norway	Yugoslavia
Poland	

* The German National Committee cast a positive vote for publication with the exception, however, of Clause 11: Insulation requirements.

Publications of Technical Committee No. 41 are classified on a hierarchical basis:

First level: General standards.
Second level: Generic standards relating wholly or partly to a family of relays.
Third level: Standards applicable wholly or partly to a particular group of relays.
Fourth level: Particular requirements or specifications relating to a specific type (or pattern) of relay.

This standard is a third level publication.

Other IEC publications quoted in this standard:

Publications Nos. 50 (131):	International Electrotechnical Vocabulary (I.E.V.), Chapter 131: Electric and magnetic circuits.
255-0-20:	Electrical Relays. Contact Performance of Electrical Relays.
255-5:	Part 5: Insulation Tests for Electrical Relays.
255-6:	Part 6: Measuring Relays with More than One Input Energizing Quantity.
255-6A:	First Supplement to Publication 255-6.
255-12:	Part 12: Directional Relays and Power Relays with Two Input Energizing Quantities.

ELECTRICAL RELAYS

Part 16: Impedance measuring relays

SECTION ONE — GENERAL AND DEFINITIONS

1. Scope

This standard specifies the general requirements for impedance measuring relays. These relays constitute a particular sub-family of measuring relays with more than one input energizing quantity as defined in IEC Publication 255-6, Part 6: Measuring Relays with More than One Input Energizing Quantity.

This standard specifies test methods and methods of presenting relay characteristics and performance. It covers multi-input energizing quantity measuring relays in which impedance is a characteristic quantity and for which the operating characteristics are defined in the $R-X$ plane.

This standard applies to independent or dependent specified time relays.

Relays coming within the scope of IEC Publication 255-12, Part 12: Directional Relays and Power Relays with Two Input Energizing Quantities, are excluded.

All tests in this standard are type tests.

This standard applies only to relays in new condition.

Notes 1. — The term relay includes all the additional components which are necessary for its operation and which are tested with it.

2. — The voltage(s) and/or current(s) contributing to the measurement of the impedance can be either simple quantities or combinations of more than one voltage and/or more than one current, for example the difference of two phase-to-ground voltages, the sum of a phase current and residual current, etc. To obtain specific operating characteristics which may have special properties (e.g. directional) the energizing quantities may be mixed or additional input quantities may be brought into the relay.

2. Definitions

For definitions of general terms not defined in this standard, reference should be made to the IEC International Electrotechnical Vocabulary (I.E.V.), to IEC Publication 255-6, and to IEC Publication 255-6A: First Supplement to IEC Publication 255-6 (1978).

For the purpose of this standard, the following definitions shall apply:

2.1 *Source impedance* Z_s

For a particular fault location, the source impedance is the impedance in the equivalent circuit of the fault current path between the point where the voltage is applied to the measuring relay and the e.m.f. in the equivalent circuit producing the fault current in the same path.

Note. — Where necessary, the source impedance takes into account its positive, negative and zero sequence components.

2.2 *Steady-state characteristic*

The characteristic resulting from a slow change in the value of at least one of the input energizing quantities.

2.3 *Dynamic characteristic*

The characteristic resulting from a sudden change in the value of at least one of the input energizing quantities, including the effect of any aperiodic component.

2.4 *Transient characteristic*

The characteristic resulting from transient variations in the value of the input energizing quantities such as magnetizing in-rush current, travelling waves, etc.

SECTION TWO — REQUIREMENTS

3. Standard values

3.1 *Input and auxiliary energizing quantities and frequency*

The standard values of input and auxiliary energizing quantities and of frequency are specified in IEC Publication 255-6.

3.1.1 *Effective range of input energizing quantities*

There are no standard effective ranges of input energizing quantities. These shall be declared by the manufacturer.

3.1.2 *Operative ranges of auxiliary energizing quantities*

The standard values of operative ranges of auxiliary energizing quantities are specified in IEC Publication 255-6A.

3.2 *Characteristic quantity*

There are no standard values of the characteristic quantity or of its setting range.

3.3 *Specified times*

There are no standard values of specified times.

3.4 *Standard reference values of influencing quantities and factors and standard values of their nominal and extreme ranges*

3.4.1 *Influencing quantities and factors*

The standard reference conditions are given in Table I of IEC Publication 255-6. In addition, the standard conditions specified in Table I of this standard apply to impedance measuring relays.

TABLE I

Standard reference conditions and test tolerances of influencing quantities and factors

Influencing quantity or factor		Reference condition	Test tolerance
Characteristic and input energizing quantities	Input energizing voltage(s)	As declared by the manufacturer or as specified in national standards unless specified in this standard or in lower level documents	
	Input energizing current(s)		
	Phase angle between input energizing quantities		
	D.C. component in a.c., transient	Zero, unless specified in the clauses of this standard (see note)	5% of peak a.c. value
Auxiliary energizing quantities	D.C. component in a.c., transient	Zero (see note)	5% of peak a.c. value

Note. — In the special case of relays in which polyphase measurements are made on a single relay, the manufacturer or national standard shall define which of the input quantities shall be under reference conditions.

3.4.2 *Limits of the nominal ranges of the influencing quantities and factors*

The standard values are specified in Table II of IEC Publication 255-6. In addition, the standard values specified in Table II of this standard apply to impedance measuring relays.

3.5 *Values of the limits of the operative range of the auxiliary energizing quantities*

The standard values of the limits of the operative range of the auxiliary energizing quantities are specified in the IEC Publication 255-6A.

TABLE II

Standard values of the limits of the nominal ranges of influencing quantities and factors

Influencing quantity or factor		Nominal range
Characteristic and input energizing quantities	Input energizing voltage(s)	As declared by the manufacturer or as specified in national standards
	Input energizing current(s)	
	Phase angle between input energizing quantities	
	Frequency	
	Waveform	
	D.C. component in a.c., steady state	
	D.C. component in a.c., transient	
Auxiliary energizing quantities	Voltage or current	As declared by the manufacturer or as specified in national standards unless specified in this standard
	Frequency	
	Waveform	
	A.C. component in d.c. (ripple)	0% to 12% of the rated d.c. value*
	D.C. component in a.c., steady state	As declared by the manufacturer or as specified in national standards unless specified in this standard
	D.C. component in a.c., transient	

* This value of tolerance is based on the new definition I.E.V. 131-03-14: Peak ripple factor.

4. Methods of presenting relay characteristics and performance

4.1 *Operating characteristics*

The manufacturer shall declare the operating characteristics in the $R-X$ plane, in graphical form or by mathematical formulae. The operating characteristics shall be referred to the relay impedance setting(s). The exact significance of the setting value shall be defined by the manufacturer, i.e. whether it is in terms of the phase or loop impedance. The effect of influencing quantities or factors such as source impedance, fault direction, type of fault, voltage value, phase angle value, etc. shall also be shown graphically or shall be stated. Typical examples of characteristics used in practice are shown in Figure 1, pages 22 and 23.